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(57) Abstract:

PURPOSE: To improve sensitivity, and to lower noises extremely by forming multi-periodic structure, in which one of mixed crystals consisting of Si, Ge and Sn is shaped in a lattice constant larger than a III-V compound semiconductor substrate and the other in a lattice constant smaller than the substrate, onto the substrate.

CONSTITUTION: A Be-doped p-GaAs buffer layer 2, a p-SiGeSn multi-periodic layer 3 as an optical absorption layer, a p-SiGe lattice mismatching relaxing layer 3', and a p-Si layer 4 for avalanche multiplication are laminated onto a Zn-doped p⁺-GaAs substrate 1 in succession through a molecular beam epitaxial method. That is, Ge_{0.85}Sn_{0.15} having a lattice constant larger than GaAs and Si_{0.85}Sn_{0.15} having a lattice constant smaller than GaAs are laminated alternately at every fifty period at every thickness such as 100Å; in the layer 3, and the Si₁₋₂GeZ layer 3' is grown so that a composition (z) is reduced with separation from the substrate, and changed into the Si layer 4. Mutually opposite electrodes 7, 8 apply reverse bias voltage between 7 and 8, and the layers 4, 3', 3 are depleted toward the substrate side from an n⁺-p junction on the

boundary of the layers 5, 4. Beams are projected through an SiO₂ layer 6.

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